

## A new species of calanoid copepod from Shark Bay, Western Australia

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### Abstract

A new species of calanoid copepod, *Centropages halinus* from hypersaline waters of Shark Bay, Western Australia is described. The new species is most closely related to *C. orsinii*, which also occurs in Shark Bay.

### Introduction

Centropagid copepods are very important in Australian coastal waters, spanning the full range of aquatic habitats, including inland saline, fresh water, estuarine and marine (Bayly 1964, McKinnon and Arnott 1985). Of the nine centropagid genera, only *Sinocalanus* and *Limnocalanus* are not represented in Australia. This paper describes a new species of the marine genus *Centropages*, taken in a survey of the planktonic communities of Shark Bay, a hypersaline marine embayment (Kimmerer *et al.* 1985).

*Centropages* at present comprises 27 valid species (Razouls 1982), of which only six have been recorded from Australian waters (*C. australiensis*, *C. bradyi*, *C. calininus*, *C. furcatus*, *C. gracilis*, *C. orsinii*), though three additional species occur in adjacent waters (*C. aucklandicus*, *C. elongatus* and *C. violaceus*). Vervoort (1964) commented that the genus was badly in need of revision, and split the species into groups based on the shape of the last metasomal segment, abdomen, morphology of leg 5 and the male antennule (Vervoort pers. comm.). The only subsequent attempt at synthesising the taxonomy of the genus is in Razouls' 1982 listing of the pelagic copepod genera.

We took plankton samples by obliquely hauling a 50 cm diameter 100  $\mu$ m plankton net from bottom to surface; station numbers are those of Kimmerer *et al.* 1985. Samples were preserved in dilute formalin and animals subsequently placed in lactic acid and drawn using a Wild M20 phase contrast microscope and camera lucida. We dissected the animals in lactic acid and mounted them in polyvinyl lactophenol on microslides. Armament formulae are presented from basis to most distal segment, and for swimming legs as outer margin first; roman numerals indicate spines, arabic numerals setae. Material is deposited in the Western Australian Museum (WAM), Perth.

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## Systematics

### *Centropages halinus*, sp. nov.

Figures 1 and 2

#### Holotype

Female, 1.03 mm, WAM 1-88 (on slide). Shark Bay Stn 13, near Faure Sill (25°45.1'S, 113°57.8'E) 13 June 1983.

#### Allotype

Male, 1.03 mm, WAM 2-88 (with 1 slide). Type locality.

#### Paratypes

Type locality, WAM 3-88 (male, 1.06 mm, on slide), WAM 4-88 (male, 1.10 mm, on slide), WAM 5-88 (3 females, 3 males). Shark Bay Stn 10 (25°39.9'S, 113°48.2'E), Shark Bay Stn 14 (25°48.5'S, 114°01.9'E), 11 June 1983, WAM 6-88 (one female), WAM 7-88 (one female), WAM 8-88 (one male, on slide). Shark Bay Stn 8 (25°39.3'S, 113°39.9'E), 7 June 1983, WAM 9-88 (one female), WAM 10-88 (one male, 1.12 mm, on slide). Shark Bay Stn 11 (25°44.5'S, 113°46.7'E), 14 June 1983, WAM 11-88 (female, on slide), WAM 12-88 (female, 0.96 mm on slide).

#### Diagnosis

*Centropages orsinii* Giesbrecht, 1899 and *C. halinus* are the only species in the genus with 2-segmented endopods on legs 1 to 3. These species are also similar in having the posterior margins of the prosome drawn into blunt, nearly symmetrical points, a character shared by only one other species, *C. sinensis* Chen and Zhang, 1965. *C. halinus* differs from *C. sinensis* in that *C. sinensis* females have a large asymmetrical lobe on the genital complex in dorsal view, and males have the right leg 5 with two terminal processes, as opposed to only one in *C. halinus*. The genital complex of the female of *C. orsinii* has a ventral spiniform process not present in *C. halinus*, and the leg 5 exopod is more robust. Males of *C. orsinii* have a long terminal process on the left leg 5 exopod 2, whereas *C. halinus* has a short spine.

#### Description

Female: Body (Figure 1a, b) 1.03 mm long (total length) comprising cephalosome and 5 thoracic segments. Pediger 5 drawn posteriorly into points. Urosome (Figure 1c) 3-segmented, glabrous except for patch of hairs on right lateral margin of genital complex.

Antennules, antennae and mouthparts similar in form to those of other species of *Centropages*. Antennule 24-segmented, bearing a marginal thorn on the anterior of each of segments 2, 3 and 5. Antenna comprises coxa with 1 seta, basis with 2 setae, 2-segmented endopod with 2,4 setae and 7-segmented exopod with 1,3,1,1,1,1,4 setae. Mandible palp coxa with 4 setae, endopod 2-segmented with 4,9 setae, exopod 4-segmented with 1,1,1,3 setae. Maxillule first outer second with 3, third with four. Fused basis and endopod segments with 9 setae,

single distinct endopod segment with 5 setae. Lobe representing exopod with 9 setae. Maxilla 2-segmented, basal segment with 4 lobes bearing 5,3,3,3 setae respectively. Terminal segment of 2 lobes bearing 3,8 setae. Maxilliped 7-segmented, with setal armature (basis first) 10,3,5,4,3,4,5.

Exopods of all legs 3-segmented (Figures 1d-h), endopods of legs 1 to 3 2-segmented, of legs 4 and 5 3-segmented. Swimming legs with armament formulae as follows:

Leg 1	Coxa 0-1	Basis 0-1	Exopod	I-1, I-1, II-I-4
			Endopod	0-3, 1-2-3
Leg 2	Coxa 0-1	Basis 0-0	Exopod	I-1, I-1, III-I-5
			Endopod	0-3, 2-2-4
Leg 3	Coxa 0-1	Basis 0-0	Exopod	I-1, I-1, III-I-5
			Endopod	0-3, 2-2-4
Leg 4	Coxa 0-1	Basis 0-0	Exopod	I-1, I-1, III-I-5
			Endopod	0-1, 0-2, 2-2-3
Leg 5	Coxa 0-0	Basis 0-0	Exopod	I-0, I-0, II-I-4
			Endopod	0-1, 0-1, 2-2-2

Female leg 5 (Figure 1h) with typical centropagid ensiform process produced from inner margin of exopod 2. Process denticulate at distal extremity.

Male: Body (Figure 2a) 1.03 mm long, similar to female, but with urosome 4-segmented. Antennule 24-segmented on left side, 22-segmented on right, geniculate between segments 18 and 19. Segments 17,18 with row of spinules produced from anterior margin (Figure 2b), segment 19 with complex row of spinules on proximal 1/3, terminating in spine lying along margin of segment.

Legs 1-4 similar to those of the female. Leg 5 much modified, with similar endopods to those of female. Left exopod (Figures 2c, d) 2-segmented, first segment carrying single outer spine, second 2 outer spines and terminal spine with adjacent inner terminal thorn. Row of hairs runs length of segment along anterior face, adjacent to inner margin. Right exopod also 2-segmented (Figure 2c), first segment carrying 2 short strong spines on outer distal margin, second segment with long thick curved process on both inner proximal margin and terminally. Small strong spine at base of terminal process, weaker spine a short distance along inner face of process.

### Etymology

The specific name is derived from the Greek for 'salt' and refers to the high salinity in which *C. halinus* was found.

### Remarks

*C. halinus* appears most closely related to *C. orsinii* on morphological grounds, an interesting phenomenon in view of their co-occurrence in the Shark Bay region.

New species of calanoid copepod

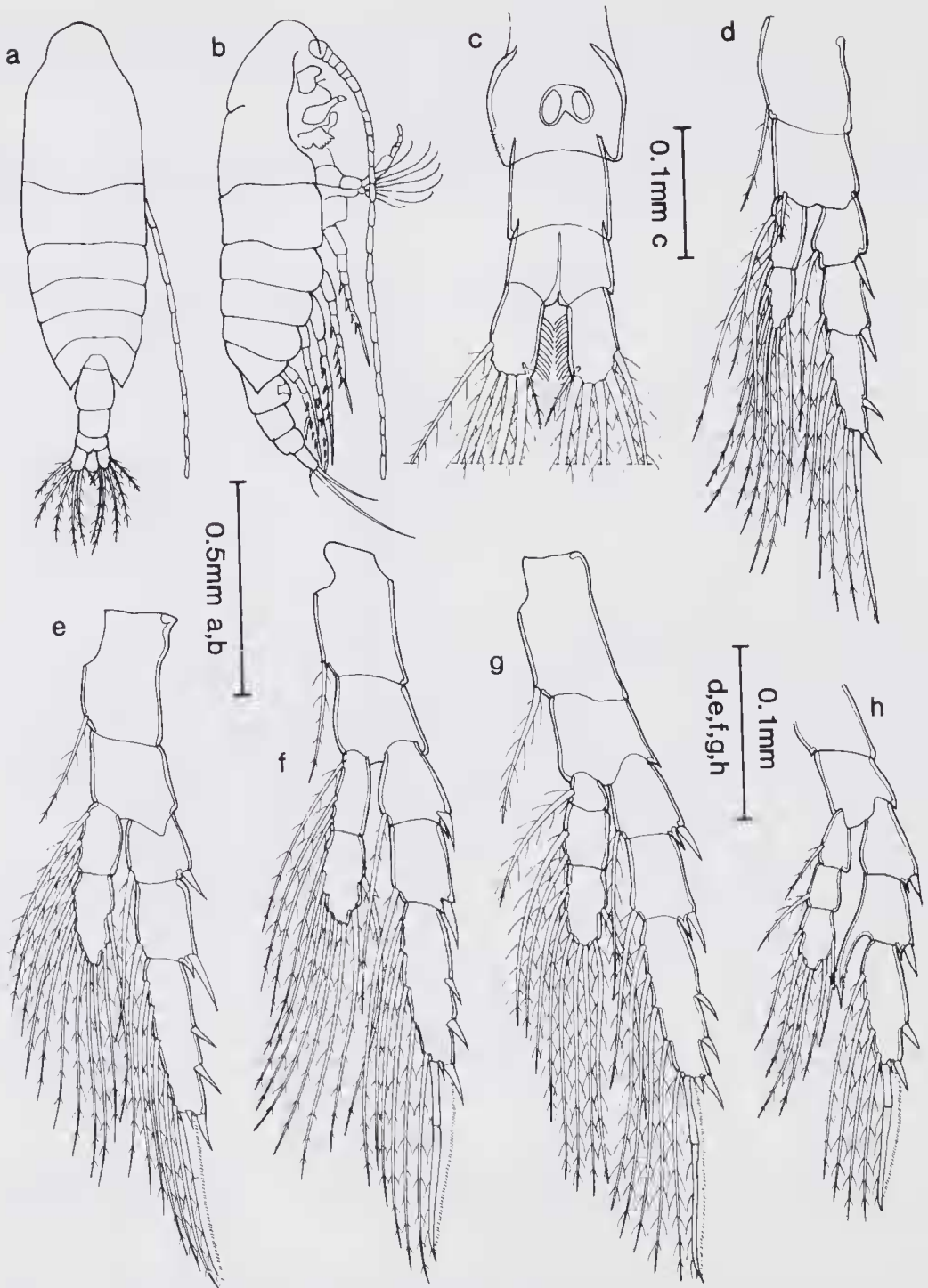


Figure 1 *Centropages halinus* new species. Female (a) habitus, dorsal; (b) lateral; (c) urosome, ventral; (d) leg 1, (e) leg 2; (f) leg 3; (g) leg 4; (h) leg 5.



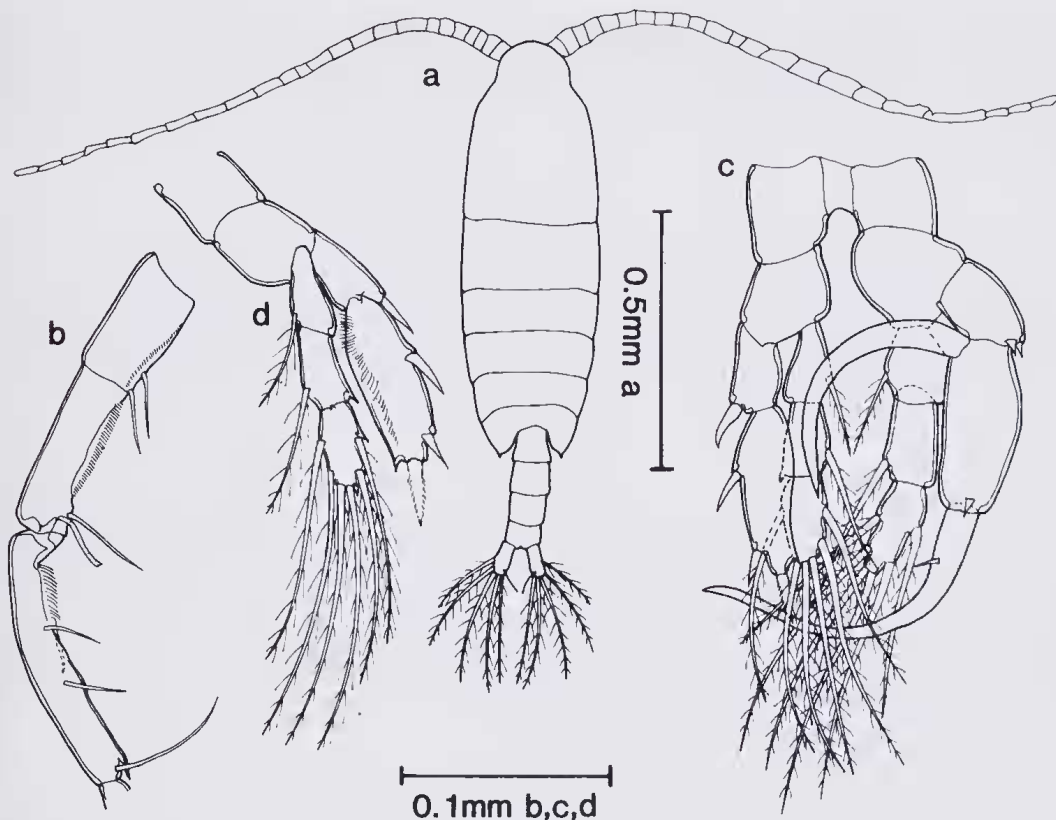


Figure 2 *Centropages halinus* new species. Male (a) habitus, dorsal; (b) segments 17, 18 and 19 of right antennule; (c) leg 5, posterior; (d) left leg 5, anterior.

*C. orsinii* is more abundant near the mouth of Shark Bay, though it was recorded in salinities as high as 39.0 ppt. (see Kimmerer *et al.* 1985, Figure 1 and Table 3 for details). *C. halinus* appears to be limited to the hypersaline inner regions of the bay, having been recorded in salinities of 39.0 to 44.4 ppt.

Irrespective of Vervoort's (1964) listing of species of the genus *Centropages*, there remain in usage a number of synonymised names. These are in the main corrected in Razouls' (1982) listing. They are: *C. arabicus* Cleve, 1904 (for *C. tenuiremis* Thompson and Scott, 1903), *C. chilensis* Krøyer, 1849 (*C. brachiatum* Dana, 1849), *C. discaudatus* Brady, 1872 (*C. aucklandicus* Kramer, 1895), *C. lenicularis* Oliveira, 1945 (*C. furcatus* Dana, 1849), *C. mcmurrichi* Willey, 1920 (*C. abdominalis* Sato, 1913), *C. notoceras* Cleve, 1904 (*C. dorsispinatus* Thompson and Scott, 1903), *C. pacificus* Chiba, 1956 (*C. elongatus* Giesbrecht, 1896), and *C. yamadai* Mori, 1934 (*C. tenuiremis* Thompson and Scott, 1903). García-Rodríguez (1985) confirms the specific status of *C. ponticus* Karawaew, 1895 as distinct from *C. kroyeri* Giesbrecht, 1892. *C. velificatus* (Oliveira, 1946) was listed by Razouls (1982) as a synonym of *C. furcatus* Dana, 1849, but Fleminger and Hulsemann (1973) describe these as distinct species, with

the former endemic to the Atlantic, and the latter Indo-Pacific. *C. tenuicornis* Brady, 1914 remains a nomen dubium. Brodsky (1967) argued that *C. mcmurrichi* should be used in preference to *C. abdominalis*, but the latter clearly has priority.

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### References

- Bayly, I.A.E. (1964). A new species of *Isias* (Copepoda: Calanoida) from the Brisbane River estuary, and a comparison of the Australian Centropagid genera. *Australian Journal of Marine and Freshwater Research* 15: 239-247.
- Brodsky, K.A. (1967). Calanoida of the far eastern seas of the USSR. Keys to the fauna of the USSR. *Zoological Institute of the Academy of Sciences of the USSR No. 35*. Israel Program for Scientific Translations Jerusalem.
- Fleminger, A., Hulsemann, K. (1973). Relationship of Indian Ocean epiplanktonic Calanoids to the world oceans. *Ecological Studies* 3: 339-348.
- García-Rodríguez, M. (1985). Contribución al conocimiento de la biología de *Centropages ponticus* Karavaev (Copepoda, Calanoida). *Boletín Instituto Español de Oceanografía* 2: 47-52.
- Kimmerer, W.J., McKinnon, A.D., Atkinson, M., Kessell, J. (1985). Spatial distributions of plankton in Shark Bay, Western Australia. *Australian Journal of Marine and Freshwater Research* 36: 421-32.
- McKinnon, A.D., Arnott, G.H. (1985). The developmental stages of *Gladiferens pectinatus* Brady, 1899 (Copepoda, Calanoida). *New Zealand Journal of Marine and Freshwater Research* 19: 21-42.
- Razouls, C. (1982). Répertoire mondial taxonomique et bibliographique provisoire des Copepodes planctoniques marins et des eaux saumâtres. Divers systèmes de classification. Tome II. Université Pierre et Marie Curie. Paris. Laboratoire Arago. Banyuls-sur-mer. pp. 375-875.
- Vervoort, W. (1964). Notes on two Pacific species of *Centropages* (Copepoda, Calanoida), *C. australiensis* Fairbridge, 1944 and *C. aucklandicus* Kramer, 1895. *Crustaceana (Leiden)* 7: 293-311.